

# Spontaneous Leak and Transection of Permanent Subclavian Catheters

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**Background and Objectives:** Implanted central venous access ports are frequently used. Spontaneous break and catheter transection are serious but rare complications of permanent subclavian catheters. We report our experience with this serious complication and identify possible warning signs.

**Materials and Methods:** Between 1990 and 1996, 285 permanent subclavian catheters were placed at the Sheba Medical Center, Tel Hashomer, Israel.

**Results:** We evaluated the patient population for this complication and searched for possible warning signs. A total of 12 patients (4.2%) with this complication were identified, 8 with transection and distal embolization and 4 with a partial tear only. The pinch-off sign was noted as an early warning in only 5 patients. All other patients developed symptoms only immediately before the diagnosis of this complication. The mean duration from insertion to identification of tear or transection was 9.6 months (range 1–24 months).

**Conclusion:** Awareness and clinical suspicion are most important in identification and prevention of this serious complication. Catheters should be taken out when treatment is completed or after 12 months in order to prevent catheter breaks. *J. Surg. Oncol.* 1998;68:166–168. © 1998 Wiley-Liss, Inc.

**KEY WORDS:** subclavian catheter; tear; transection

## INTRODUCTION

Implanted central venous access ports are frequently used when long-term venous access is needed for the delivery of medications, home hyperalimentation, and frequent blood sampling [1]. Totally implantable systems inserted with the use of a peel-away sheath to facilitate rapid insertion are commonly used.

Central venous thrombosis and infection are the most common and serious complications when using these ports. Their incidence ranges between 0% and 16% [1–3]. Spontaneous break and transection of the catheter is yet another serious complication. Although the catheter “pinch-off” sign is a well-recognized warning [4,5], prevention of catheter tear is almost impossible. We undertook this study to evaluate this complication and identify possible warning signs in our patient population.

## MATERIALS AND METHODS

We reviewed the medical records of 285 patients who underwent placement of permanent subclavian catheters at the Chaim Sheba Medical Center. The mean age of all patients was  $55 \pm 12$  years; the patient population consisted of 108 male (38%) and 177 female patients (62%). Administration of chemotherapy was the main indication for placement of the catheter.

The surgical technique that was used for introduction was as described in the literature [6–9]. All catheters were inserted with a peel-away sheath under local anes-

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TABLE I. List of Catheter Leak and Transection Events

Patient No.	Age	M/F	Catheter type	Tumor type	Duration of catheter (in mo)	Symptoms	Pinch-off sign	Type of complication	Treatment
1	35	M	Port-A-Cath	Seminoma	12	Pain, discomfort	No	Transection, distal embolization	Radiographic removal and surgery
2	49	M	Port-A-Cath	Colon cancer	1	Pain, discomfort	Yes	Longitudinal tear	Surgical removal
3	40	F	Chemosite	Breast cancer	3	Pain, discomfort during treatment	No	Tear	Surgical removal
4	46	F	Port-A-Cath	Breast cancer	16	Pain, discomfort during treatment	No	Transection, distal embolization	Radiographic removal and surgery
5	40	F	Port-A-Cath	Breast cancer	12	Pain, discomfort during treatment	Yes	Tear	Surgical removal
6	68	M	Chemosite	Colon cancer	3	Pain, discomfort subclavicular area	Yes	Tear	Surgical removal
7	40	F	Chemosite	Breast cancer	8	Pain during treatment	No	Transection, distal embolization	Radiographic removal and surgery
8	60	F	Chemosite	Breast cancer	13	Discomfort, pain	Yes	Transection, distal embolization	Radiographic removal and surgery
9	55	F	Port-A-Cath	Breast cancer	11	None (chest radiography)	No	Transection, distal embolization	Radiographic removal and surgery
10	52	F	Chemosite	Colon cancer	9	Pain during treatment	Yes	Transection, distal embolization	Radiographic removal and surgery
11	55	F	Chemosite	Colon cancer	24	Pain during treatment	No	Transection, distal embolization	Radiographic removal and surgery
12	50	F	Chemosite	Breast cancer	3	Discomfort, malfunction	No	Transection, distal embolization	Radiographic removal and surgery

thetia in an operating room under fluoroscopic surveillance. Guidewire and catheter position were evaluated by intraoperative fluoroscopy to optimize catheter position in every patient. The catheter position was also checked by a regular chest radiograph obtained shortly after completion of the surgical procedure. All 285 devices placed were subcutaneous port devices. In this study, 126 (44%) of the devices were Port-A-Cath (Pharmacia, Uppsala, Sweden) and 159 were ChemoSite (Device Labs, Inc., Norwalk, CT). The performance of the ports was followed until their removal or the patient's demise.

## RESULTS

A total of 285 central venous access devices were placed between 1990 and 1996. Since fluoroscopy was used intraoperatively for all operations, not a single case of incorrect catheter positioning necessitated return to the operating room.

Most catheters were introduced for chemotherapy administration and remained in place until the patient's death due to primary disease or when the oncologists believed there was no further need for it. Three main indications warranted the removal of the central venous access device: cessation of therapy, thrombosis, and infection. In addition, we identified 12 (4.2%) patients with a partial tear or transection of the catheter (Table I).

Of the 12 patients, transection with distal embolization was noted in 8, and a tear only was identified in 4 patients. The embolized catheter segments were success-

fully removed in all 8 patients by transcatheter cardiocentesis, using a snare wire and fluoroscopy to retrieve the torn segment. The proximal segment and the port were removed surgically. The removed catheters were examined for the location of the tear. Patient charts, oncological notes, chemotherapy administration notes, as well as chest radiographs were reviewed.

All 12 tears occurred at the site where the catheter passed over the first rib. The mean duration from insertion to the identification of a tear and/or transection for the whole group was 9.6 months (range 1–24). The mean time period that elapsed from insertion to observation of a tear was 4.7 months (range 1–12) and to the diagnosis of a transection 12 months (range 3–24).

In five patients, early predicting symptoms that included discomfort in the shoulder and the insertion site, or difficulty and resistance to drug injection, were noticed shortly after the device placement. In the other patients, signs and symptoms occurred only immediately before the diagnosis of catheter fracture. Symptoms included pain at injection, resistance to injection, chest wall swelling at the insertion site, chest pain, palpitations, and premature ventricular contractions. The "pinch-off" sign was seen in only five patients.

We were unable to identify any correlation between the type and frequency of chemotherapy introduced, occurrence of infection, as well as the type of device used and occurrence of catheter fracture. The rate of other complications was 26 (9.1%) infections, 5 (1.8%) hema-

tomas, 10 (3.5%) pneumothorax, and 4 (1.4%) subclavian vein thrombosis.

## DISCUSSION

Implanted central venous access devices have aided the care and treatment of the oncology patient. As with any medical procedure, recognition of complications is important in an effort to avoid them.

Although rarely reported, catheter tear and transections are a potentially dangerous complication that may result in migration of the distal catheter fragment with subsequent embolization to the right side of the heart or pulmonary artery and may cause life-threatening arrhythmia. The incidence of this complication is estimated to be 0.1–1% [6].

The mechanism of catheter injury has been related to chronic mechanical friction as the catheter passes between the clavicle and the first rib [4,5], giving rise to the so-called “pinch-off” sign. However, this sign was noted on radiography before catheter fracture in only 5 of our 12 patients suffering from this complication. Although about the same rate was noted in the literature, the “pinch-off” sign is the most specific indicator for potential catheter fracture and transection and should lead to removal of the catheter.

Early warning symptoms of “catheter compression syndrome” occurred in only 5 of our 12 patients and included intermittent catheter malfunction, resistance to fluid administration, and pain during treatment. This has been the experience in the literature as well. These symptoms may sometimes occur sporadically in well-placed functioning catheters. If they persist, the catheter should be investigated by means of a chest radiograph and injection of contrast material. When a fracture occurs, the acute signs include those noted for catheter compression, as well as pain in the shoulder, swelling, and pain around the device insertion site that increase with infusion of fluid or medications and palpitation. Chest radiography and contrast injection through the device will confirm the diagnosis in these patients.

Our results demonstrate that a tear most probably precedes a transection as the average time to identification of a leak is earlier (4.7 months vs. 12 months). It is unfortunate that warning signs and symptoms occur in only half of the patients. We also could not find any correlation between catheter fracture and the appearance of other complications such as thrombosis, occlusion, and infection. No correlation was found with the type of chemotherapy or material administered by catheter.

Catheter breakage appears to be related to medial placement of the catheter in the subclavian vein, probably because of the shearing force produced between the clavicle and the first rib. Some surgeons believe that it can be avoided by using the internal jugular (or ce-

phalic vein) approach [10]. However, the jugular approach is less suited for permanently implanted devices and may be associated with a somewhat higher rate of infection [3].

The appropriate duration of catheter use is an unresolved issue. However, since catheter-related complications and mainly breaks are a function of time, we believe that catheters should not be left in for the duration. When the indication for insertion is not relevant, they should be removed. The medical and nursing staff taking care of the patient should be aware of the potential tear and transection of the device. When a “pinch-off” sign is identified after catheter insertion or when difficulty in catheter function or pain around the device or shoulder appear in a previously well-functioning catheter, a chest radiograph with contrast should be taken. It is possible that even well-functioning catheters should be replaced after 12 months use in order to prevent this complication.

## CONCLUSIONS

Tear and transection of catheter are serious complications of the permanent implantable catheter. It should be prevented by correct insertion or by removal of the catheter when not needed or after 12 months. Whenever there are signs suggesting “pinch-off,” the catheter should be removed even if it still functions. Other warning signs should prompt an investigation of catheter function. The staff who take care of the patients should be nurses with special education and experience. We believe that if these recommendations are considered, the complication rate will be lower.

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